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## NOTEWORTHY LEJEUNEAE FROM FLORIDA<sup>1</sup>

ALEXANDER W. EVANS

Our knowledge of the Hepaticae occurring in Florida has been materially increased during the past few years. This is due in great part to the careful collections made by Mr. Severin Rapp in the vicinity of Sanford, Orange County, although Dr. J. K. Small, Mr. N. L. T. Nelson and other collectors have made notable discoveries. In 1915 Miss Caroline C. Haynes<sup>2</sup> published a list of sixty-four species which Mr. Rapp had found, including twenty-four members of the Lejeuneae. In the present paper six additional Lejeuneae are noted. Four of these are apparently undescribed, although one has already been reported from Sanford under another name. One of the remaining species has been previously reported from Cuba and the other from Jamaica. Of the new species two, according to our present knowledge, are endemic to Florida. The number of Lejeuneae now known from Sanford is twenty-nine; from the entire state of Florida, forty-four; from the entire United States, forty-eight.

### 1. *Cololejeunea contractiloba* sp. nov.

Plants very delicate, pale green, scattered or growing in loose mats: stems prostrate, 0.03 mm. in diameter, irregularly and sometimes abundantly branched, the branches widely spreading, similar to the stem: leaves distant to subimbricated, obliquely to widely spreading, the lobe plane or slightly convex, sometimes inflexed at the apex, ovate to ovate-lanceolate, when well developed 0.2–0.3 mm. long and 0.12–0.18 mm. wide, but often considerably smaller, gradually narrowed to an acute apex tipped with a single cell, both dorsal and ventral margins rounded in the basal half and straight or nearly so in the apical half, crenulate or denticulate from projecting cells; lobule often rudimentary, when well developed broadly ovate, about 0.13 mm. long and 0.11 mm. wide, strongly inflated throughout, apical tooth consisting of a single rounded projecting cell, lying in a more ventral plane than the rest of the free margin and bearing the hyaline papilla at its dorsal base, proximal tooth scarcely evident, consisting of a rounded cell separated from the apical tooth by a single cell, sinus

<sup>1</sup> Contribution from the Osborn Botanical Laboratory.

<sup>2</sup> Bryologist 18: 19–22. 1915.

shallow and very short; cells of lobe averaging  $10\ \mu$  along the margin,  $16 \times 14\ \mu$  in the median and basal portions, each bearing a conical papilla on the dorsal surface, walls slightly thickened at the tips of the papillae, otherwise thin throughout; cells of lobule plane; stylus none; inflorescence autoicous: ♀ inflorescence borne on a somewhat elongated branch, innovating on one side, the innovation short and

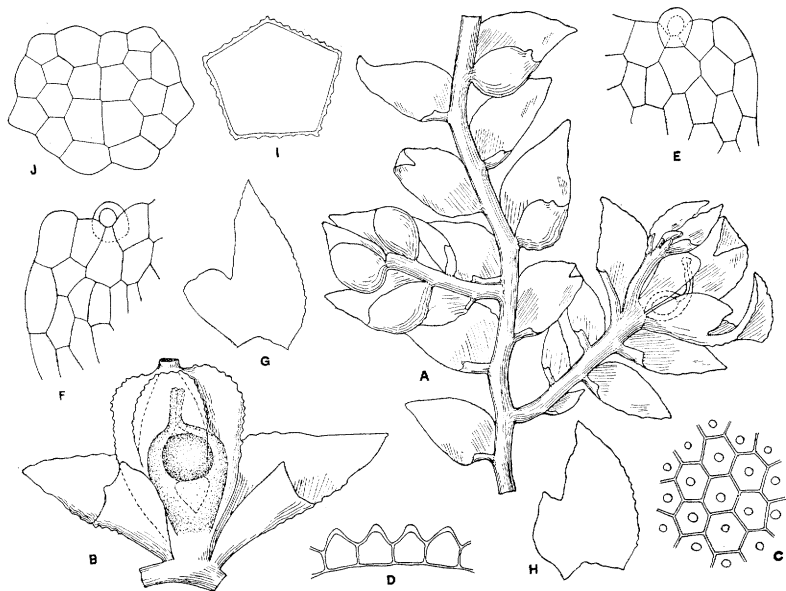


FIG. 1. *COLOLEJEUNEA CONTRACTILOBA* Evans

A. Part of a plant with male and female inflorescences, ventral view,  $\times 65$ . B. Perianth and bracts, base of innovation at left, ventral view,  $\times 65$ . C. Cells from middle of lobe,  $\times 300$ . D. Cells of keel, optical section,  $\times 300$ . E. Apex of lobule, ventral view,  $\times 300$ . F. Apex of lobule, dorsal view,  $\times 300$ . G, H. Bracts from a single involucre,  $\times 65$ . I. Transverse section of perianth just above middle,  $\times 65$ . J. Gemma,  $\times 300$ . The figures were all drawn from the type specimen.

sterile; bracts obliquely spreading, more or less complicate, the lobe ovate to ovate-lanceolate, mostly 0.35–0.45 mm. long and 0.12–0.2 mm. wide, apex, margin and cells as in the leaves, lobule ovate to obovate, mostly 0.15–0.2  $\times$  0.1 mm., rounded to more or less pointed at the apex; perianth obovate in outline, about 0.35 mm. long and 0.25 mm. wide, terete in lower half, five-keeled above, the keels blunt below, sharper above, rounded at the apex, beak of perianth short but distinct, surface in upper part roughened as in the leaves: ♂ inflorescence terminal on a more or less abbreviated branch, not pro-

liferating (so far as observed); bracts in one or two pairs, similar to the leaves but less widely spreading and with relatively shorter lobes, monandrous: capsule about 0.18 mm. in diameter: spores greenish, 12–20  $\mu$  in short diameter, minutely verruculose: gemmae abundantly produced, about 0.05 x 0.06 mm., composed (normally) of twenty cells, each apical quadrant cutting off three segments, margin crenulate from projecting cells, the youngest two segments on each side sharper, organs of attachment none. [FIG. 1.]

On bark of trees. FLORIDA: Sanford, 1913–1917, *S. Rapp*. The specimen collected in 1915 (September 28), which bears well-developed perianths, may be designated the type. The specimen collected in 1913 was at first referred by the writer to *C. Biddlecomiae* and is reported under this name by Miss Haynes.

Among the species of *Cololejeunea* known from Florida, *C. Biddlecomiae* (Aust.) Evans and *C. tuberculata* Evans agree with *C. contractiloba* in having roughened leaves and perianths. In all three cases the roughness is due to projecting cell-walls, more or less thickened at the tips of the projections. It is best marked in *C. tuberculata*, where the lobules as well as the lobes of the leaves and perichaetial bracts are usually roughened and where the projections are longer and more thickened at their tips. In the other two species the lobules are invariably smooth, and the projections are shorter and less thickened.

The lobules of the new species are especially interesting because they show the features characteristic of the genus in an abridged or reduced form. In other words the apical tooth, instead of being two cells or more long, consists of a single projecting cell, while the proximal tooth is scarcely apparent. The apical tooth is further remarkable because it lies in a more ventral plane than the rest of the free margin, the hyaline papilla lying in the same plane. In both *C. Biddlecomiae* and *C. tuberculata* the apical tooth is normally two cells long and lies in the same plane as the rest of the margin, while the proximal tooth is usually distinct.

Aside from the differences just noted *C. contractiloba* differs from *C. Biddlecomiae* in its smaller size, in its lack of a filiform stylus, and in the narrower lobes and lobules of its perichaetial bracts; it differs from *C. tuberculata* in its slightly larger size, in the entire lobules of its perichaetial bracts and in the distinct beak of its perianth. Four other species of *Cololejeunea* are definitely known from Florida at the present time. Since, however, the leaves of all are smooth or nearly so, there is little danger of confusing them with the present species.

**2. *Lejeunea cladogyna* sp. nov.**

Pale or dull green, sometimes becoming yellowish or brownish with age, growing in loose mats: stems mostly 0.08–0.1 mm. in diameter, sparingly and irregularly pinnate, the branches widely spreading and sometimes subdivided, often with smaller leaves than the stem but not microphyllous: leaves contiguous to loosely imbricated, the lobe obliquely to widely spreading, plane or slightly convex, subfalcate, broadly ovate, when well developed about 0.45 mm. long and 0.4 mm. wide, dorsal margin sometimes arching partially across the axis, sometimes not, sometimes strongly outwardly curved from the base to the broad and rounded apex, sometimes straight or slightly incurved in the basal region, ventral margin slightly outwardly curved to straight, margin entire throughout; lobule when well developed inflated, broadly ovoid, 0.09–0.12 mm. long and 0.09 mm. wide, keel straight or slightly arched, roughened from projecting cells, forming a very broad angle with the ventral margin of lobe, free margin somewhat involute to beyond the apex, sinus oblique and very shallow, apical tooth a rounded, straight, slightly projecting cell with a hyaline papilla or its proximal side; lobule usually poorly developed and reduced to a minute basal fold; cells of lobe averaging about  $16\ \mu$  along the margin and  $28 \times 18\ \mu$  in the median and basal portions, thin-walled throughout or with minute and indistinct trigones and intermediate thickenings, cuticle smooth; ocelli none: underleaves distant, ovate to ovate-orbicular, about 0.15 mm. long and 0.12–0.15 mm. wide, bifid about one half with an acute to lunulate sinus and erect, triangular, sub-acute lobes, margin entire: inflorescence autoicous: ♀ inflorescence borne on a very short branch, with only one vegetative leaf and one bracteole in addition to the involucre leaves, innovating on one side, the innovation short and sterile (so far as observed); bracts obliquely spreading, the lobe oblong to obovate, when well developed about 0.3 mm. long and 0.16 mm. wide, rounded at the apex, entire, lobule about 0.2 mm. long and 0.08 mm. wide, narrowly oblong, the free portion 0.06 mm. long or less, obtuse to rounded at the apex; bracteole somewhat connate on one or both sides, oblong, about 0.3 mm. long and 0.16 mm. wide, bifid about one fourth with a narrow sinus and erect, rounded or very obtuse lobes, margin otherwise entire; perianth long-exserted, narrowly obovoid, about 0.6 mm. long, and 0.3 mm. wide, truncate at the apex and with a short beak, narrowed toward the base, sharply five-keeled above the middle, the keels indistinctly crenulate or denticulate from projecting cells, surface otherwise smooth: ♂ inflorescence occupying a short branch, not proliferating; bracts in two or three pairs, closely imbricated, strongly inflated, shortly bifid with a strongly arched, crenulate keel, and blunt divisions; antheridia in pairs; bracteole usually single at the base of the inflorescence, minute, shortly bifid: mature capsule about 0.2 mm. in diameter. [FIG. 2.]

On trees, logs, and sandy banks. FLORIDA: Caloosa, without date, *C. F. Austin*; Sanford, 1906-1913, *S. Rapp* 6, 19, 64, 64a, 64b, 69; Gainesville, 1916, *N. L. T. Nelson* 104. PORTO RICO: near San-turce, 1899, *Mr. & Mrs. A. A. Heller* 616, 1365; near Mayaguez, 1906, *E. G. Britton & D. W. Marble*, mixed with 542; near Mayaguez, 1914, *E. G. Britton* 1906. Mr. Rapp's No. 64 may be designated the type. The specimens collected by Austin are in the Underwood

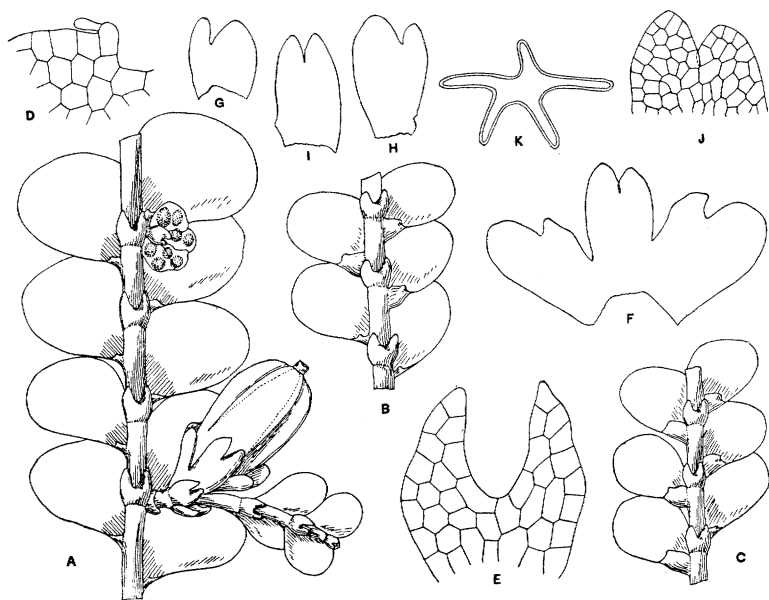


FIG. 2. *LEJEUNEA CLADOGYNA* Evans

A. Part of a robust plant with perianth and male inflorescence, ventral view,  $\times 40$ . B, C. Parts of sterile plants, showing well-developed lobules, ventral view,  $\times 40$ . D. Apex of lobule,  $\times 225$ . E. Underleaf,  $\times 225$ . F. Bracts and bracteole,  $\times 50$ . G-I. Bracts and bracteole from another involucre, torn apart,  $\times 50$ . J. Apex of bracteole shown in F,  $\times 100$ . K. Transverse section of a perianth in upper third,  $\times 50$ . The figures were all drawn from the type specimen.

Herbarium, now belonging to the New York Botanical Garden. In spite of their sterility Austin recognized their distinctness and gave them a manuscript name. Since this name has since been applied to a species from New Caledonia it is not available for the American plant.

In many species of *Lejeunea* the female branches vary greatly in length. This is strikingly true in the case of *L. minutiloba* Evans, a species of the West Indian lowlands, closely related to *L. cladogyna*. A female branch in this species is sometimes greatly elongated and sometimes so short that it bears a single vegetative leaf and a single underleaf in addition to the bracts and bracteole. Between these two extremes all intermediate conditions occur. In *L. cladogyna* the female branches, so far as observed, are always very short and conform to the second of the two extremes noted under *L. minutiloba*. It would perhaps be premature to state that this condition is absolutely constant, but it is certainly predominant, and it therefore seems justifiable to regard it as one of the distinctive characters of the species.

In size and in general habit *L. cladogyna* and *L. minutiloba* resemble each other very closely, and the inflorescence in both species is autoicous. In *L. cladogyna*, moreover, the lobule is usually reduced to a minute basal fold. While, however, this condition seems to be constant in *L. minutiloba*, inflated lobules of the usual *Lejeunea* type are occasionally produced in *L. cladogyna*, although many plants seem to lack them completely. The new species is further distinguished by its underleaves, bracts and perianths. The underleaves, even, when well developed, are only a little broader than the stem and the divisions are rarely more than four cells wide at the base; the lobules of the bracts are highly connate with the lobes and sometimes approximate them in length; the perianth is rounded at the apex, and the five keels extend to the middle or beyond. In *L. minutiloba* the underleaves are often twice as broad as the stem and the divisions may be six or more cells wide; the lobules of the bracts are less highly connate with the lobes and much shorter, appearing like small basal appendages; the perianth is truncate or slightly retuse at the apex, and the keels are restricted to the apical portion.

In *L. glaucescens* Gottsche, another West Indian species found also in Florida, the female branch seems to be constantly very short, just as in *L. cladogyna*, and the two species agree further in their autoicous inflorescence and in the fact that their lobules are often poorly developed. *L. glaucescens*, however, is a larger and more delicate species than *L. cladogyna* and has larger leaf-cells, the median cells of the lobes averaging about  $33\ \mu$  in length. It is further distinguished by its sharper lobules and by the sharper divisions of its bracteoles.

Two other species of *Lejeunea*, *L. floridana* Evans and *L. flava* (Sw.)

Nees, are known from Florida. *L. floridana* agrees with *L. glaucescens* in most of its vegetative characters, but is distinguished from it by its much larger bracts and bracteole, by the short keels of its perianth (projecting slightly upward as horns), and by the fact that the female branches are often long. These features will serve to separate the species also from *L. cladogyna*. *L. flava* is distinguished by its larger size, by its much larger underleaves (which are often imbricated), by the variable length of its female branches, and by its usually well-developed lobules of the *Lejeunea* type.

### 3. LEJEUNEA LONGIFISSA Steph.

*Lejeunea longifissa* Steph. Sp. Hepat. 5: 747. 1915. [FIG. 3.]

On bark of trees. FLORIDA: Sanford, March, 1917, *S. Rapp* 83. CUBA: Monte Verde, February, 1859, *C. Wright*. The type material was collected in Cuba, no further data being given by Stephani. Since the type has not been available for comparison, the writer has been dependent upon the original description, which agrees in all essential respects with the specimens listed above.

The plants are pale green and cling closely to the substratum, forming thin irregular mats. As in so many of the *Lejeuneae* the best development of the leaves is found on sterile branches, rather than on those bearing sexual organs. In the latter position the lobules of the leaves are often imperfectly formed, although they rarely show the extreme reduction found in *L. cladogyna* and *L. minutiloba*. On sterile branches the leaves are loosely arranged and sometimes do not overlap at all. The lobes are plane or nearly so and spread obliquely. They are broadly ovate and slightly falcate, measuring, according to Stephani, 0.67 x 0.4 mm. The Florida specimens do not attain these dimensions, the largest lobes being about 0.4 x 0.3 mm., but the Cuban specimens have lobes 0.3–0.6 mm. in length. The apex of the lobe varies from rounded to very bluntly pointed, while the margin is entire or vaguely sinuate. The lobule, when well developed, is strongly inflated throughout, broadly ovate in outline, and measures about 0.12 x 0.1 mm. The free margin is involute as far as the apical tooth, which consists of a single, slightly projecting, blunt cell, with the usual hyaline papilla on the proximal side. The leaf-cells have thin walls with distinct trigones and frequent intermediate thickenings. According to Stephani the marginal cells measure 18  $\mu$ , the median 27  $\mu$ , and the basal cells 45 x 27  $\mu$ , these measurements agreeing with those made by the writer.



The underleaves are small and distant and show in general an orbicular outline. They are deeply bifid with an obtuse to lunulate sinus and erect or incurved lanceolate divisions, tipped with one or two cells and usually four cells wide at the base. The lateral margins are entire or vaguely and bluntly unidentate on the sides. The underleaf just below a perichaetial bracteole is usually larger than the others, with slightly broader divisions.

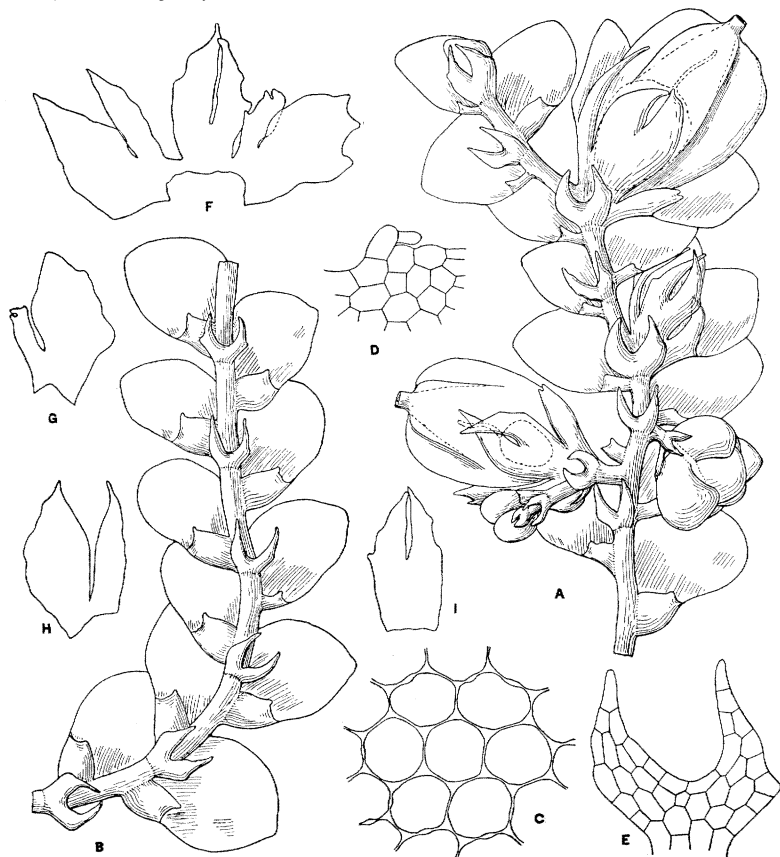


FIG. 3. *LEJEUNEA LONGIFISSA* Steph.

A. Part of plant with two perianths and a male inflorescence, ventral view,  $\times 50$ . B. Part of a sterile stem, ventral view,  $\times 50$ . C. Cells from middle of lobe,  $\times 300$ . D. Apex of lobule,  $\times 225$ . E. Underleaf,  $\times 225$ . F. Bracts and bracteole,  $\times 50$ . G-I. Bracts and bracteole from another involucre, torn apart,  $\times 50$ . The figures were all drawn from Mr. Rapp's specimens, No. 83.

The inflorescence is autoicous, as in all the other species of *Lejeunea* known from the United States. The female inflorescence is sometimes borne on a short branch and sometimes on a more or less elongated branch. It innovates on one side and occasionally on both, the innovations being sometimes short and sterile, sometimes again floriferous. The bracts are exceedingly variable. The lobe of the outer bract is usually broad and blunt, the margin varying from entire to coarsely and irregularly sinuate or toothed. The lobe of the inner bract is usually narrow and sharper. The lobule of the outer bract is also blunt in most cases and often shows two indistinct teeth at the apex; the lobule of the inner bract is usually slender and long-pointed. Unfortunately these differences between the bracts are not always apparent. The bracteole is slightly connate on both sides; it is deeply bifid with a narrow sinus and slender, long-pointed divisions, and the margin is sometimes sparingly and irregularly toothed. The perianth is obovoid and distinctly five-keeled, the dorsal keel being shorter than the two ventral. The keels are crenulate and sometimes show very narrow and interrupted wings. The apex of the perianth is rounded or truncate and the beak is distinct. The measurements of the involucre leaves and perianths which Stephani gives are somewhat higher than those made by the writer. According to him the lobes of the bracts measure  $0.9 \times 0.45$  mm. while the perianth is said to be 1.25 mm. long and 0.67 mm. wide. In the writer's experience the lobes of the bracts measure  $0.35-0.7 \times 0.22-0.35$  mm., and the perianth  $0.5-0.9 \times 0.35-0.5$  mm. Stephani speaks of the perianth as being "quasi pedunculata," so that his measurements were evidently made from plants which had passed maturity. In view of the great variation in size exhibited by the bracts and perianths, the discrepancies just noted hardly seem sufficient to warrant a specific separation. The male spikes vary in position and in length and apparently never proliferate. They sometimes occupy short branches and sometimes terminate long branches, and the bracts are mostly in two to six pairs. The antheridia are borne singly or in pairs.

Perhaps the most striking features of *L. longifissa* are the deeply bifid underleaves, from which it receives its specific name, and the variable perichaetial bracts, some of which at least have sharp-pointed and coarsely toothed lobes. In all the other species of *Lejeunea* known from Florida the lobes of the bracts are either rounded or very bluntly pointed, while their margins are entire or vaguely

crenulate. The underleaves with their lanceolate divisions resemble somewhat those of *L. pililoba* Spruce and *L. spiniloba* Lindenb. & Gottsche, but they agree even better with those of *Microlejeunea laetevirens* (Mont. & Nees) Evans on account of the fact that they are sometimes unidentate on the sides.

#### 4. RECTOLEJEUNEA MAXONII Evans

*Rectolejeunea Maxonii* Evans, Bull. Torrey Club 39: 609. pl. 45, f. 17-27. 1912.

On bark of trees. FLORIDA: Gainesville, March, 1916, *N. L. T. Nelson* 79, 92; Robinson's Spring, eight miles south of Sanford, April, 1917, *S. Rapp* 87. ALABAMA: Auburn, September, 1900, *F. E. Lloyd & F. S. Earle*. PORTO RICO: Mount Morales, near Utuado, March, 1906, *M. A. Howe* 453. The species was based on the following specimens, collected in 1903, at Cinchona, JAMAICA: *L. M. Underwood* 495; *W. R. Maxon* 1361 (type); *A. W. Evans* 143 in part. No other stations are at present known.

The specimens from Florida and Alabama bear numerous female inflorescence but show neither perianths nor androecia. Since they are slightly smaller than the original material of *R. Maxonii* from Jamaica, it at first seemed unwarranted to refer them definitely to that species. The specimens from Porto Rico, however, bridge over the gap. Most of them are no larger than the plants from the United States, while others equal the Jamaican plants in size. In other respects the specimens from the different localities show an essential agreement. In all probability the range of *R. Maxonii* will be still further extended, now that its characteristics are more accurately understood.

In the original account of the species vegetative reproduction by means of caducous leaves was described but was reported as a rare phenomenon. The Florida specimens show that this is by no means the case. The majority of the stems examined have produced caducous leaves in abundance, and some of them have become almost leafless. In most instances plants of this character are sterile, but an occasional archegonium is produced, the bracts remaining firmly attached. When archegonia are abundant, the tendency to form caducous leaves is much less evident and seems to become completely inactive in plants with perianths. When the species was first proposed as new the lobes of the vegetative leaves were said to measure

0.5 x 0.4 mm. This size is rarely attained in the Porto Rican specimens, and then only in the vicinity of perianths. Most of the leaves are only 0.3–0.35 mm. in length by 0.3 mm. or less in width. Similar but less constant discrepancies are to be found in the perianths. One interesting peculiarity of the perichaetial bracteoles should be alluded to. Although their lateral margins may be entire or nearly so, as the original description perhaps implies, it is more usual for them to be irregularly toothed, and in many cases a single large tooth on each side can be demonstrated.

The close relationship between *R. Maxonii*, *R. phyllobola* (Nees & Mont.) Evans and *R. Brittoniae* Evans was emphasized in the original publication of the species, and the differential characters were there contrasted. The dioicous inflorescence will at once distinguish *R. Maxonii* from the autoicous *R. phyllobola*. From *R. Brittoniae*, which is likewise dioicous, the best differential characters are drawn from the androecia. In *R. Brittoniae* these bear bracteoles along their entire length; in *R. Maxonii* at the base only. In the absence of androecia, the smaller size and paler color of *R. Maxonii* will usually serve to distinguish it.

### 5. *Euosmolejeunea parvula* sp. nov.

Pale or dull green, sometimes becoming brownish with age, scattered or growing in loose mats; stems mostly 0.06–0.08 mm. in diameter, copiously and irregularly branched, the branches widely spreading and often subdivided, not microphyllous: leaves imbricated, the lobe obliquely to widely spreading, plane or slightly convex, falcate, broadly ovate, mostly 0.25–0.35 mm. long and 0.2–0.3 mm. wide, dorsal margin arching partially or wholly across the axis, sometimes straight at base but usually strongly outwardly curved from the base to the broad and rounded apex, ventral margin straight or slightly outwardly curved, forming a straight line or a very obtuse angle with the keel, margin entire throughout; lobule inflated throughout, ovoid, about 0.1 mm. long and 0.07 mm. wide, keel straight to somewhat arched, roughened from projecting cells, free margin strongly involute to beyond the apex, sinus oblique and shallow, apical tooth a single, blunt, projecting cell with a hyaline papilla in a slight depression at its distal base; cells of lobe about 12  $\mu$  in diameter at the margin and 20 x 16  $\mu$  in the median and basal portions, thin-walled but usually with minute trigones, cuticle smooth; ocelli none: underleaves distant to contiguous, broadly ovate to orbicular, when well developed mostly 0.12–0.16 mm. long and 0.12–0.14 mm. wide, bifid about one half with a sharp and often narrow sinus and erect triangular lobes, obtuse to subacute at the apex,

margin entire: inflorescence autoicous: ♀ inflorescence borne on a more or less abbreviated branch, sometimes with only a single vegetative leaf and a single underleaf in addition to the bracts and bracteole, innovating on one side, the innovation short and usually sterile but sometimes bearing a second ♀ inflorescence; bracts obliquely spreading, sharply or bluntly keeled, the lobe falcate, ovate to obovate, about 0.45 mm. long and 0.3 mm. wide, rounded to very bluntly pointed at the apex, margin entire or vaguely sinuate, narrowly oblong, about 0.3 mm. long and 0.09 mm. wide, the free portion scarcely 0.06 mm. long, rounded to acute; bracteole free, ovate-elliptical, about 0.4 mm. long and 0.3 mm. wide, bifid about one third with a narrow sinus and erect or connivent lobes, obtusely to acutely pointed, margin entire or vaguely crenulate; perianth about half exserted, obovoid, mostly 0.6–0.7 mm. long and 0.45 mm. wide, cuneate toward the base, rounded to truncate at the apex with a short beak, five-keeled, dorsal keel shorter and blunter than the others, extending scarcely to the middle, lateral keels sharp, ventral keels usually united into a broad two-angled keel, lateral and ventral keels sometimes very narrowly and vaguely winged, slightly roughened from projecting cells, surface of perianth otherwise smooth: ♂ inflorescence terminal on a more or less elongated branch or occupying a short branch, sometimes proliferating; bracts mostly in four to six pairs, imbricated, about as large as the vegetative leaves, strongly inflated, shortly bifid with a rounded dorsal lobe, a pointed ventral lobe, and a strongly arched keel slightly roughened from projecting cells; antheridia in pairs; bracteoles mostly two at the base of the inflorescence, similar to the underleaves: mature capsule about 0.2 mm. in diameter. [FIG. 4.]

On bark. FLORIDA: Sanford, January, 1917, *S. Rapp* 86; Robinson's Spring, eight miles south of Sanford, May, 1917, *S. Rapp* 86a No. 86 may be designated the type.

In discussing the genus *Cheilolejeunea* several years ago the writer<sup>3</sup> called attention to the fact that its relationship to *Euosmolejeunea* was uncomfortably close. Typical species of *Cheilolejeunea*, to be sure, are clearly distinct from typical species of *Euosmolejeunea*, but other species occupy an intermediate position and might be placed in the one genus almost as well as in the other. The present species is a case in point. In its small size, general habit, foliar characters and small underleaves it agrees with *Cheilolejeunea* better than with *Euosmolejeunea*, but its five-keeled perianth indicates that it should be referred to the latter genus. Possibly, when the species of the two genera are more thoroughly understood, it may be advisable to include them under a single genus.

<sup>3</sup> Bull. Torrey Club 33: 5. 1906.

The closest known relative of *E. parvula* is *E. duriuscula* (Nees) Evans, another species on the border line between *Cheilolejeunea* and *Euosmolejeunea*. *E. duriuscula* is widely distributed in tropical and subtropical America and occurs abundantly in Florida. It is only a

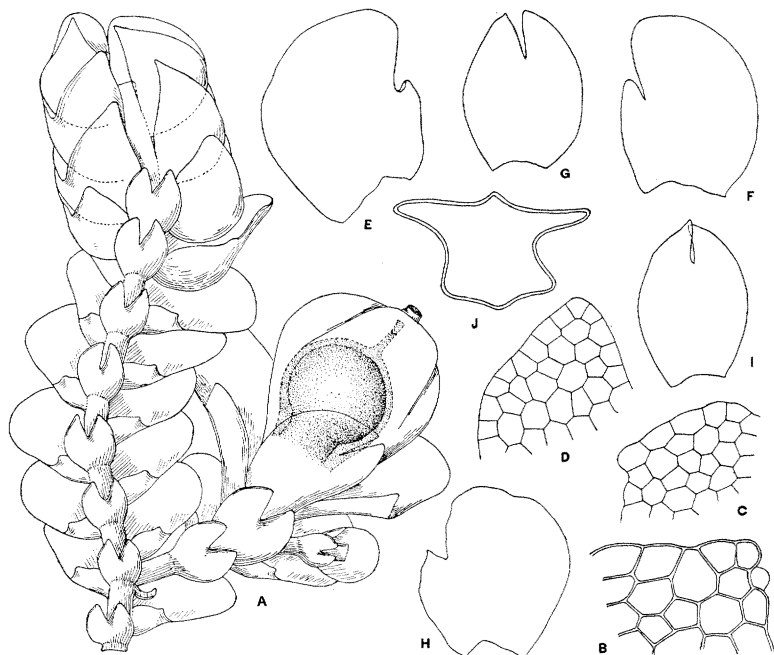


FIG. 4. *EUOSMOLEJEUNEA PARVULA* Evans

A. Part of a plant with perianth and male inflorescence, ventral view,  $\times 50$ . B. Apex of lobule, showing distal hyaline papilla,  $\times 300$ . C. Apex of another lobule, papilla not shown,  $\times 225$ . D. Apex of an underleaf-division,  $\times 225$ . E-G. Bracts and bracteole from a single involucre,  $\times 50$ . H, I. Bract and bracteole from another involucre,  $\times 50$ . J. Transverse section of a perianth in upper third,  $\times 50$ . The figures were all drawn from the type specimen.

trifle larger than *E. parvula*, the lobes of its leaves measuring about  $0.4 \times 0.35$  mm., the lobules in the two species are much like the apical tooth, being very short in both, the underleaves and leaves are very similar, and the perianths, except for a slight difference in size, agree closely. *E. duriuscula*, however, is a yellowish plant of a firmer texture, the leaf-cells have larger and more distinct trigones, the female

inflorescence is usually borne on a leading branch, and the lobules of the perichaetial bracts are relatively broader and separated from the lobes by deeper sinuses. An even more important difference than any of these is found in the autoicous inflorescence of the new species, *E. duriuscula* being invariably dioicous.

One other species of *Euosmolejeunea*, the widely distributed *E. clausa* (Nees & Mont.) Evans of tropical and subtropical America, is likewise known from Florida. This species agrees with *E. duriuscula* in its dioicous inflorescence but is characterized by its larger underleaves, distinctly rounded or cordate at the base, and by the fact that the female inflorescences are borne on more or less abbreviated branches. The dioicous inflorescence and the underleaves would at once separate *E. clausa* from *E. parvula*, although the short female branches might suggest a relationship. It is further distinguished by its yellowish-green color, by its larger size (the leaf-lobes measuring about 0.5 x 0.4 mm.), and by its firmer texture, the leaf-cells being provided with distinct trigones, just as in *E. duriuscula*.

Other Florida species with which *E. parvula* might perhaps be confused are *Cheilolejeunea polyantha* Evans and *Rectolejeunea phyllobola* (Nees & Mont.) Evans. In the *Cheilolejeunea* the inflorescence is dioicous, the leaves are densely imbricated, the lobes are orbicular and measure about 0.4 mm. in diameter, the underleaves are often broader than long and are rounded or cordate at the base, and the dorsal surface of the perianth is practically without a keel. All of these features would separate it from the new species. The *Rectolejeunea* agrees with *E. parvula* in its autoicous inflorescence but is a somewhat larger plant when well developed and is further distinguished by the proximal position of the hyaline papilla associated with the apical tooth of the lobule, by the lack of a dorsal keel on the perianth and by slight differences in the form of the underleaves, bracts and bracteoles.

#### 6. *Ptychocoleus heterophyllus* sp. nov.

Yellowish or brownish green, scattered or growing in depressed mats: stems 1.5–2 mm. in diameter, sparingly pinnate, the branches obliquely to widely spreading, usually of the *Radula* type, rarely of the *Frullania* type, similar to the stem: leaves loosely to closely imbricated, squarrose when moist, the lobe falcate, ovate, 0.6–0.75 mm. long, 0.45–0.6 mm. wide, rounded at the dorsal base, then strongly outwardly curved to the rounded or very obtuse apex, margin entire; lobule broadly ovate-triangular when explanate, 0.35 mm. long,

0.3 mm. wide, the inflated portion forming a narrowly ovate water-sac, keel strongly arched near the base, then almost straight and forming a very wide angle with the slightly involute ventral margin of the lobe, free margin rounded at the base, then almost straight to junction with lobe (including the apical sinus), bearing usually from five to seven short and strongly inflexed blunt teeth, each consisting of a single projecting cell and separated from its neighbors by about two cells, apical tooth like the others, hyaline papilla proximal to the apical tooth and situated on the dorsal surface of the second cell from the margin, cells of lobe more or less convex, averaging about  $13\ \mu$  at the margin,  $25 \times 20\ \mu$  in the middle, and  $32 \times 16\ \mu$  at the base, trigones distinct, triangular, mostly with two convex sides and one concave side, intermediate thickenings infrequent, oval: underleaves loosely to closely imbricated, plane, broadly orbicular, mostly 0.3–0.35 mm. long and 0.35–0.4 mm. wide, apex rounded to truncate, base shortly cuneate, rounded, or minutely and indistinctly auriculate, margin entire: inflorescence dioicous: ♂ inflorescence at first terminal, afterwards proliferating; bracts mostly in six to ten pairs, closely imbricated, similar to the leaves but the lobe relatively broader, lobule with a broader inflated portion, ovate, truncate at the outer end, the sinus forming about a right angle with the rest of the free margin, apical tooth one or two cells long, not inflexed, margin otherwise entire or nearly so; bracteoles similar to the underleaves; antheridia in pairs: vegetative reproduction by means of small caducous leaves borne on specialized upright branches with persistent squarrose underleaves: ♀ plant unknown. [FIG. 5.]

On bark of trees. FLORIDA: Sanford, March, 1911, and May, 1912, *S. Rapp*; Robinson's Spring, eight miles south of Sanford, May, 1917, *S. Rapp*. HONDURAS: in deep swamp along Highland Creek, near Puerto Sierra (Tela), at about sea-level, February, 1903, *P. Wilson* 569. The Florida plants lack both antheridia and archegonia; the Honduras specimens bear antheridia only. Mr. Rapp's specimen, collected in 1917, may be designated the type.

The close relationship existing between *Ptychocoleus* and *Brachiolejeunea* has already been emphasized by the writer in another connection.<sup>4</sup> In their vegetative organs the two genera are essentially alike, and the only constant difference between them is the absence of subfloral innovations in *Ptychocoleus* and their presence in *Brachiolejeunea*. Since the plants just described are wholly without archegonia it is clearly impossible to determine their generic position beyond all question. They are referred to *Ptychocoleus* largely on account of their caducous leaves, borne on specialized branches, the leaves

<sup>4</sup> Bull. Torrey Club 35: 161, 162. 1908.



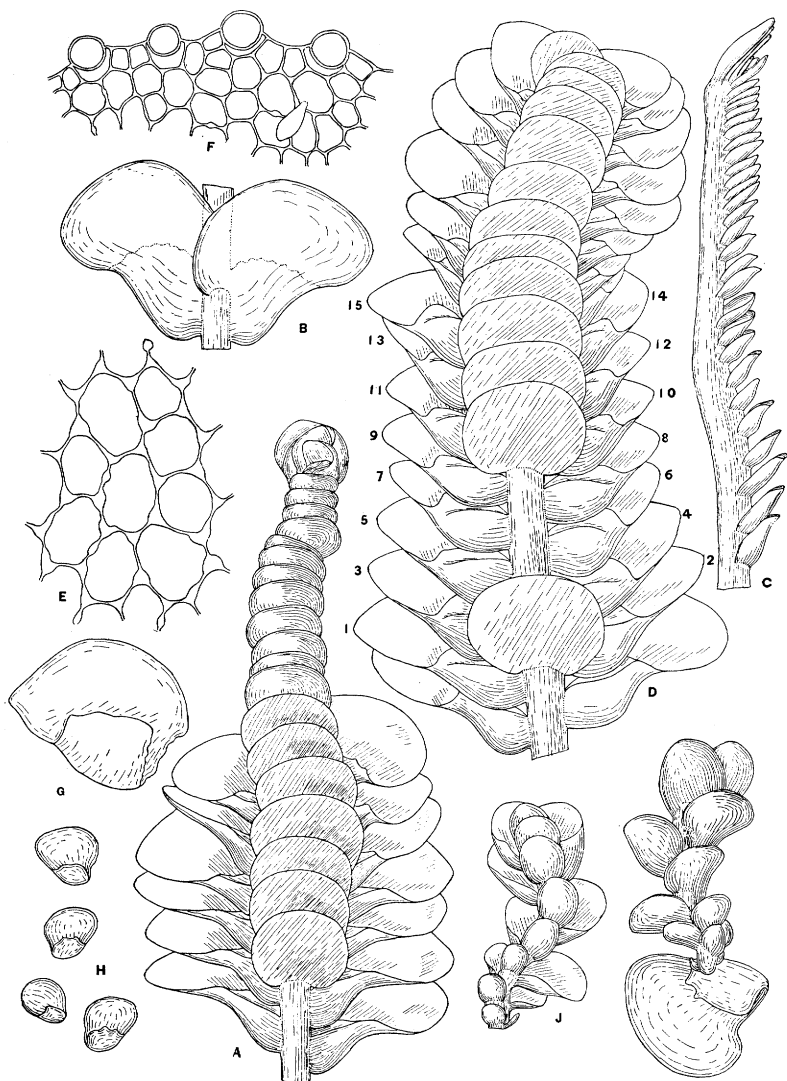


FIG. 5. *PTYCHOCOLEUS HETEROPHYLLUS* Evans

A. Part of a branch, the apical portion specialized,  $\times 40$ . B. Two vegetative leaves, dorsal view,  $\times 40$ . C. Specialized branch, lateral view,  $\times 40$ . D. Part of plant, including a male inflorescence, the male bracts numbered 1-15, ventral view,  $\times 40$ . E. Cells from middle of lobe,  $\times 300$ . F. Part of lobular margin, the apical tooth at right,  $\times 225$ . G. Male bract,  $\times 40$ . H. Caducous leaves,  $\times 40$ . I. Caducous leaf bearing a new shoot,  $\times 50$ . J. Ventral view of the same shoot,  $\times 50$ . A, B, E and F were drawn from the type specimen; C, H, I and J, from the specimen collected by Mr. Rapp in 1912; D and G, from the Honduras specimen.

serving as organs of vegetative reproduction. Such leaves and branches are unknown in *Brachiolejeunea* but are found in the South American *P. torulosus* (Lehm. & Lindenb.) Trevis.,<sup>5</sup> as understood by Spruce, although their true significance has been overlooked.

Vegetative reproduction by means of leaves which become separated and which afterwards give rise to new shoots by a process of regeneration are now known in several genera of the Hepaticae. In most cases the deciduous leaves are essentially like ordinary leaves and the line of separation is irregular. Such leaves are "Bruchblätter," according to the definition of Correns.<sup>6</sup> In rarer cases the leaves are distinctly modified and separate by means of a regular and definite line. Such leaves are "Brutblätter." Examples of the latter have been described by the writer in *Rectolejeunea flagelliformis* Evans and *R. Berteroana* (Gottsche) Evans,<sup>7</sup> and their occurrence has been noted in *Frullania Bolanderi* Aust.<sup>8</sup>

The caducous leaves of *Ptychocoleus heterophyllus* are likewise Brutblätter. Although they show the usual differentiation into lobe and lobule, both are greatly reduced in size, the lobe measuring about 0.25 x 0.2 mm. and the lobule 0.14 x 0.09 mm. The latter is further distinguished by bearing only one or two marginal teeth, not inflexed as on ordinary leaves. The separation takes place at the very base and no cells are torn across in the process. After separation the basal cells project as minute crenulations.

The branches which bear the caducous leaves vary greatly in length but their growth is limited sooner or later, and no evidence is at hand that they ever revert to the typical vegetative condition. In one case thirty pairs of leaves had been produced. The transition between ordinary leaves and caducous leaves is abrupt; as soon as the latter begin to be formed the branch curves away from the substratum and ceases to form rhizoids. The persistent underleaves are much like ordinary underleaves and their reduction in size is less marked than in the case of the leaves. They are very densely crowded, however, and are distinguished also by being squarrose and more or

<sup>5</sup> In his *Species Hepaticarum* (5: 37. 1912) Stephani cites the present writer as authority for this combination with the reference, "Torr. Bot. Cl., 1908, p. 165." If this reference is consulted it will be seen that the combination is correctly assigned to Trevisan.

<sup>6</sup> Unters. über die Vermehrung der Laubm. 338. 1899.

<sup>7</sup> Bull. Torrey Club 33: 10, 13. 1906.

<sup>8</sup> Bryologist 18: 88. 1915.

less convex. At the apex of the branch the few leaves which are still attached bend backward almost as strongly as the underleaves. After the leaves have fallen away the surface of the branch appears irregularly roughened from projecting cells, but it is difficult to determine the actual lines of attachment. The upright leafless branches, with their persistent and crowded underleaves, present a very distinctive appearance. Aside from *P. torulosus* branches of this character have not been noted in the Lejeuneae Holostipae. They may be compared with the flagelliform branches found in *Frullania Bolanderi* and in the two species of *Rectolejeunea* noted above.

The behavior of the caducous leaves after they have fallen away was observed in but a single instance. In this case a new shoot had grown out from the lower surface of the lobule not far from the apical tooth. This shoot was leafy from the very base and had immediately formed undivided underleaves as well as leaves. The latter, although small, showed distinct lobules. In the few Lejeuneae where germination has been observed the spore first gives rise to a row of cells (sometimes very short), then to a flat thallus and finally to a leafy shoot. In certain other genera the leafy shoot at its beginning is destitute of underleaves and shows undivided leaves, even though the adult shoot bears well-developed underleaves and bilobed leaves. It is of interest to note that the shoot growing out of the caducous leaf in *P. heterophyllus* showed none of these embryonic features. At the same time it would be premature to draw any general conclusions from a single example, and it is probable that cases of more pronounced reversion may yet be discovered. It is also probable that the new shoots do not always arise from the lobule. In *Rectolejeunea flagelliformis*, where the caducous leaves lack lobules, the new shoots grow out from the margin of the lobes, and it would be natural to suppose that the *Ptychocoleus* might show the same phenomenon.

The lobular teeth in *P. heterophyllus* are usually five to seven and are remarkable for their uniform structure and regular spacing. On account of their being so strongly inflexed it is easy to overlook them, and their features can only be made out satisfactorily by careful dissection. Each tooth consists of a single projecting cell borne on a broader basal cell, and the apical tooth is indistinguishable from the others except by its position. The proximal tooth, however, is often less definite. The apical sinus, in explanate lobules, continues the

line of the free margin and does not form a distinct depression. On the underleaves basal auricles are occasionally present, but they are never well developed, and are always difficult to demonstrate.

The South American *P. torulosus* is still incompletely known and it is possible that the species, as at present defined, represents an aggregate. The type specimen was collected in "Guiana," and the species has since been reported from Dutch Guiana, from Venezuela, and from Brazil. In the Hepaticae Spruceanae specimens were distributed from Obidos, Brazil, and from the vicinity of Chimborazo, Ecuador. These and a portion of the type material in the Mitten herbarium have been available for study.

In the type specimen perianths are present but neither androecia nor caducous leaves were detected. The plants are considerably larger than those of *P. heterophyllus*, and the lobes of the leaves are relatively broader, measuring 1.1–1.3 mm. in length and 0.95–1.2 mm. in width. The ventral margin of the lobe is further distinguished by being distinctly revolute. The margin of the lobule is said to be entire in the original description, but the marginal teeth were soon noted by Lindenberg and Gottsche.<sup>9</sup> They usually number four to six and are less strongly inflexed than those of the new species but resemble them in other respects. The underleaves measure about 0.5 mm. in length and 0.75 mm. in width; in most cases they show small basal auricles, but these are not always distinct and may be absent altogether. A leaf, an underleaf, an involucre, and a perianth in cross section have been figured by Schiffner,<sup>10</sup> presumably from material in the Lindenberg Herbarium at Vienna.

Spruce's specimens are scarcely larger than those of *P. heterophyllus*, but their leaves agree in shape with those of the type from Guiana, measuring about 0.75 mm. in width and scarcely more than that in length. The underleaves, too, are much broader than long and usually show distinct auricles. The free margin of the lobule, however, offers a few distinctive features, when compared with the type. Although the number of teeth is about the same, the apical tooth is longer than the others and extends outward, instead of being inflexed, a distinct sinus being thus formed between the apical tooth and the distal portion of the margin. The other teeth are inflexed, but not very strongly so. The branches with caducous leaves are

<sup>9</sup> *Linnaea* 24: 627. 1851.

<sup>10</sup> *Hedwigia* 33: pl. 7, f. 8–10. 1894.

probably referred to by Spruce when he speaks of "rami decurvi apice subaphyllo." They agree in all essential respects with those of *P. heterophyllus*.

Two species of *Brachiolejeunea* are known from Florida at the present time, *B. corticalis* (Lehm. & Lindenb.) Schiffn.<sup>11</sup> and *B. bahamensis* Evans.<sup>12</sup> Both usually bear perianths in abundance with the subfloral innovations characteristic of the genus. They are both somewhat darker than the new *Ptychocoleus*, and are slightly more robust, their leaf-lobes measuring about 0.9 mm. in length. Further differences in the marginal teeth of the lobules may be noted. There are usually four of these teeth in *B. corticalis* and five in *B. bahamensis*, the teeth being only slightly inflexed, so that it is possible to flatten them out. In *B. corticalis* the teeth are relatively simple, but in *B. bahamensis* they are usually three or four cells in length and show considerable irregularity.

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<sup>11</sup> See Evans. Mem. Torrey Club 8: 131. pl. 18, f. 1-11. 1902.

<sup>12</sup> Evans. Bull. Torrey Club 35: 383. pl. 28, f. 1-4. 1908.